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(54) Title:	WASHING MACHINE		
(57) Abstract	<p>Washing machine containing a fixed outer drum (1), an inner drum (2) mounted therein in a rotatable manner and provided with openings (3), which is provided with ribs (19) on the inside, means (4) to rotate the inner drum (2), a water inlet (5) which opens in the outer drum (1), and a water outlet (6) which is connected to the bottom side of the outer drum (1), characterized in that it contains means (7) to inject water under high pressure in the inner drum (2).</p>		
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<p>The diagram illustrates a cross-section of a washing machine. It features a large outer drum (1) with a ribbed interior surface. Inside, an inner drum (2) is mounted in a rotatable manner. The inner drum has several openings (3) and is supported by a central bearing assembly (4). A water inlet (5) is located on the side of the outer drum, and a water outlet (6) is positioned at the bottom. High-pressure injection means (7) are shown injecting water into the inner drum through a tube (8) and nozzle (9). A pump (10) is connected to the system, along with various valves and piping (11, 12, 13, 14, 15, 16, 17, 18, 20, 21).</p>			

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Washing machine.

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The present invention concerns a washing machine with a fixed outer drum, an inner drum mounted therein in a rotatable manner and provided with openings, which is provided with ribs on the inside, means to rotate the  
10 inner drum, a water inlet which opens into the outer drum and a water outlet which is connected to the bottom side of the outer drum.

During the washing, the outer drum is filled with water  
15 up to a certain level. This water is supplied more or less warm or it is heated in the outer drum, for example by means of steam injection, and washing product is added to this water.

20 As a result of the rotation of the inner drum, the laundry is taken out of the water by the ribs, after which it falls back into the water again.

A good washing result is obtained by combining this  
25 mechanical action, the temperature of the water, the amount of washing product and the time. These four factors are related to one another, which implies that one of these factors can be reduced when another one is increased.

30

Raising the temperature of the water or increasing the amount of washing product is not economical, since washing products and high temperatures represent the major part of the costs when washing nowadays.

Increasing the washing time is nor very practical, nor economical.

That is why some have tried to increase the mechanical  
5 action by optimizing the position and dimensions of the  
ribs on the inner drum.

The thus obtained improvement of the washing result is  
restricted, however.

10 Also, the invention aims to remedy the above-mentioned  
disadvantages and to provide a washing machine with which  
can be obtained a better washing result in an economical  
manner.

15 This aim is reached according to the invention in that  
the washing machine contains means to inject water under  
high pressure in the inner drum.

20 Thanks to the injection under high pressure, the  
mechanical action is considerably increased in a cheap  
manner.

25 Preferably, the above-mentioned means also contain means  
to evacuate water from the outer drum while water is  
being injected under high pressure, in practically  
corresponding amounts.

30 In this case, the means to inject water under high  
pressure may contain a closed circuit in which is mounted  
a high-pressure pump to put the water under high  
pressure.

This water under high pressure may be inserted via one or

several nozzles, for example sprinkler nozzles. These nozzles may be provided on the outer drum, but they are preferably situated in the loading door, the backside of the inner drum or the ribs on the inner drum.

5

In the latter two cases, the water under pressure is supplied via a rotating connection and through a duct in the shaft with which the inner drum is mounted in a rotating manner in the outer drum.

10

In order to better explain the characteristics of the invention, the following preferred embodiments of a washing machine according to the invention are described, as an example only without being limitative in any way, 15 with reference to the accompanying drawings, where:

figure 1 schematically represents a cross section of a washing machine according to the invention;

20

figures 2, 3 and 4 are schematic, axial sections of a part of a washing machine, but with reference to a second, a third and a fourth embodiment of the invention respectively.

25

The washing machine as represented in figure 1 contains a fixed outer drum 1 which is erected with its shaft in a horizontal position, a co-axial inner drum 2 situated in the latter in a rotatable manner which is provided with openings 3, means, consisting of a motor 4 and/or a 30 transmission, to drive the inner drum 2, a water inlet 5 which opens into the inside of the outer drum 1, a water outlet 6 which is connected to the bottom side of the outer drum 1 and means 7 to inject water under high pressure in the inner drum 2.

These means 7 consist of a closed circuit in which are mounted a reservoir 8 and a high-pressure pump 9.

The reservoir 8 is connected with the conduit 10 to an 5 outlet 11 which is connected to the bottom side of the outer drum 1 and onto which is mounted a valve 12. This reservoir 8 is connected to the high-pressure pump 9 by means of a conduit 13.

10 The outlet of the high-pressure pump 9, which supplies a pressure of more than 8 bar, for example 100 bar, and a delivery of for example 10 litres per min., is connected via conduits 14 to four nozzles 15, consisting for example of sprinkler nozzles, which are mounted evenly 15 distributed over the circumference in the fixed outer drum 1.

Also on the water inlet 5 and the water outlet 6 are mounted valves 16 and 17 respectively.

20 The valves 12, 16 and 17 are electrically controlled valves which are controlled together with the high-pressure pump 9 and the motor 4 by a control unit 18.

25 On the inside of the inner drum are provided ribs or blades 19.

In the reservoir 8 are provided heating means consisting of resistors 20, which can heat up the water to about 30 90 degrees C.

The washing machine works as follows:

After the washing machine has been filled with laundry,

the control unit 18 orders the valve 16 to open while the other valves are closed, such until the required level 21 is reached, for example such that a fourth of the inner drum 2 is filled with water.

5

This level can be determined for example by means of a float indicator, not represented in figure 1, which sends a signal to the control unit 18 as soon as the level is reached, after which this control unit 18 orders the 10 valve 16 to close.

In a known manner, the required washing products are put in the water, after which the control unit 18 orders the motor 4 to start, which sets the inner drum 2 in motion.

15 This inner drum 2 can be rotated continuously or intermittently, possibly alternately in one or the other direction.

Immediately thereafter, the control unit 18 activates the 20 high-pressure pump 9 and it simultaneously orders the valve 12 to open, such that this valve lets through almost the same delivery as the delivery which is injected via the four nozzles 15, and, as a result, the level in the drums 1 and 2 remains practically unchanged.

25

The temperature of the water is raised as required by the resistors 20 in the reservoir or by means of steam injection.

30

As, during the washing, water is constantly pumped in a closed circuit through the inner drum 2 by the means 7, and thus also through the reservoir 8, all the water is finally heated.

It is possible to activate the high-pressure pump 9 only after the water in the drum 2 has reached the required temperature.

- 5 However, the water could also or partly be heated by means of for example resistors which are mounted at the bottom in the fixed outer drum 1, or also by means of heating means which are erected outside the actual washing machine, for example means for steam injection,  
10 or by a combination of these possibilities with resistors in the reservoir 8.

The laundry in the inner drum 2 is not only washed in the conventional manner as a result of the mutual friction of  
15 pieces of laundry, but moreover also thanks to an additional mechanical action, namely the action of water under high pressure on the laundry. Said water, which is injected through the nozzles 15, ends up on the laundry in motion through the openings 3 in the inner drum 2.

20 The embodiments according to figures 2 to 4 only differ from the above-described embodiment in that the nozzles 15 are not provided in the outer casing 1, but on other places, so that it is avoided that part of the injection  
25 force is lost because the water jet collides with the inner drum 2.

In the embodiment according to figure 2, the nozzles 15 are mounted in the loading door 22 which closes off the  
30 horizontal inner drum 1 on the front side. The sprinkler nozzles which form these nozzles 15 thus spurt directly in the inner drum 1 via the opening 23 in the front side of this inner drum.

Naturally, the nozzles 15 are situated above the water level 21 in the outer drum 1, whereas the conduits 14 connect onto these nozzles 15 via a flexible part so as to make it possible for the loading door to open.

5

In the embodiment according to figure 3, the nozzles 15 are provided in the backwall of the inner drum 2, so that it is also possible to spurt directly in the inner side of this inner drum 2.

10

The end of the conduit 14 which feeds the nozzles 15 is connected via a rotating coupling 24 onto a duct 25 which extends axially through the shaft 26 with which the inner drum 2 is bearing-mounted in relation to the outer drum 15 and which is connected to the nozzles 15 via ducts in or conduits 27 on the backwall of the inner drum 2.

The embodiment according to figure 4 only differs from the preceding embodiment in that the ducts or conduits 27 20 in the backwall of the inner drum 2 go through the ribs 19 and further axially up to the nozzles 15 which are provided in these ribs 19.

According to a variant of this embodiment, the ribs may 25 be hollow, whereby the nozzles may be replaced by ordinary nozzles directly in the ribs, for example on an inwardly directed edge of these ribs.

According to all these embodiments, a significantly 30 better washing result can be obtained in a simple and relatively cheap manner by injecting water under high pressure in the inner drum 2.

The present invention is by no means restricted to the

above-described embodiments as represented in the accompanying drawings; on the contrary, such a washing machine can be made in all sorts of variants while still remaining within the scope of the invention.

5

In particular, the washing machine does not necessarily need to contain an inner drum forming one compartment. This drum can be relatively long and can be divided in several compartments in the axial direction. Such 10 washing machines, called washing streets, are mainly used in industrial laundries. The laundry is put in the washing machine at one end and is automatically moved from one compartment to the other and subjected to a washing or rinsing operation in each compartment.

15

Further, the drums can be suspended in any way whatsoever, namely on a hanging shaft, on a shaft provided at each end, etc.

20 According to the invention, such a washing street may be provided with means to inject water under high pressure in these compartments of the inner drum where a washing operation takes place.

Claims.

- 5 1. Washing machine containing a fixed outer drum (1), an inner drum (2) mounted therein in a rotatable manner and provided with openings (3), which is provided with ribs (9) on the inside, means (4) to rotate the inner drum (2), a water inlet (5) which opens in the outer drum (1),  
10 and a water outlet (6) which is connected to the bottom side of the outer drum (1), characterized in that it contains means (7) to inject water under high pressure in the inner drum (2).
- 15 2. Washing machine according to claim 1, characterized in that the means (7) to inject water under pressure also contain means (11-12) to evacuate water from the outer drum (1) while water is being injected under high pressure, in practically corresponding amounts.
- 20 3. Washing machine according to claim 2, characterized in that the means (7) to inject water contain a closed circuit in which is mounted a high-pressure pump (9).
- 25 4. Washing machine according to any of the preceding claims, characterized in that the means (7) to inject water contain one or several nozzles (15).
- 30 5. Washing machine according to any of the preceding claims, characterized in that the nozzles (15) consist of sprinkler nozzles.
6. Washing machine according to any of claims 4 or 5, characterized in that the nozzles (15) are provided on

10

the outer drum (1).

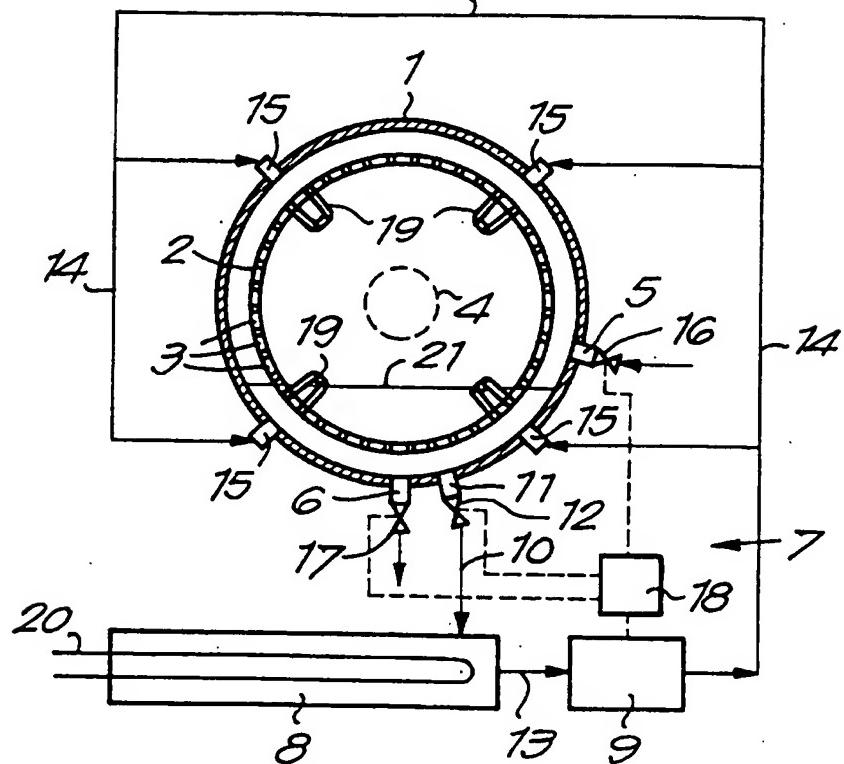
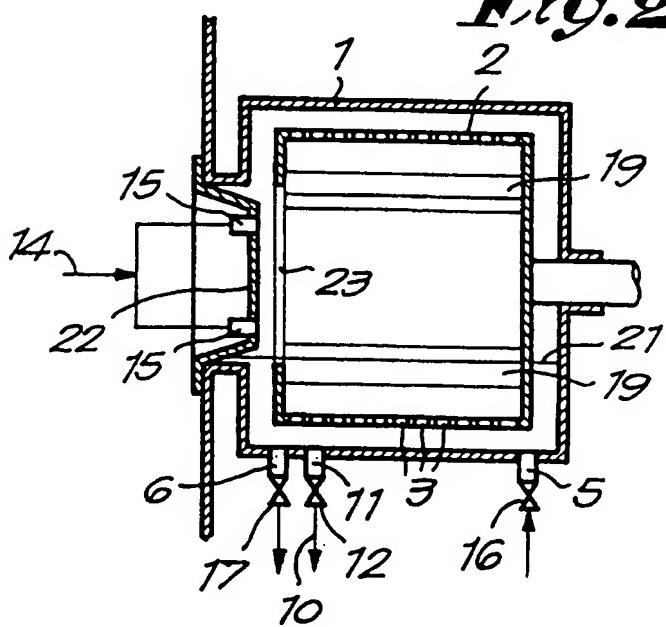
7. Washing machine according to any of claims 4 or 5,  
characterized in that the nozzles (15) are situated in  
5 the loading door (22).

8. Washing machine according to any of claims 4 or 5,  
characterized in that the nozzles (15) are situated in  
the  
10 backwall of the inner drum (2).

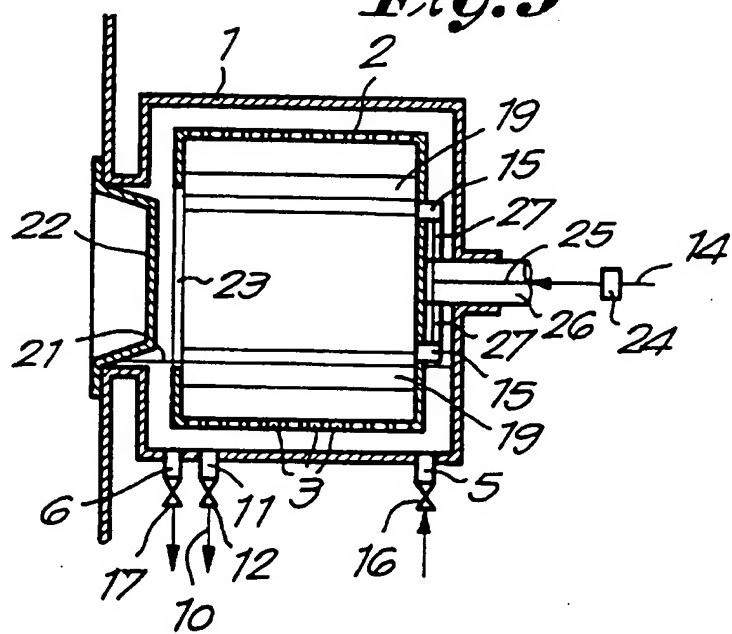
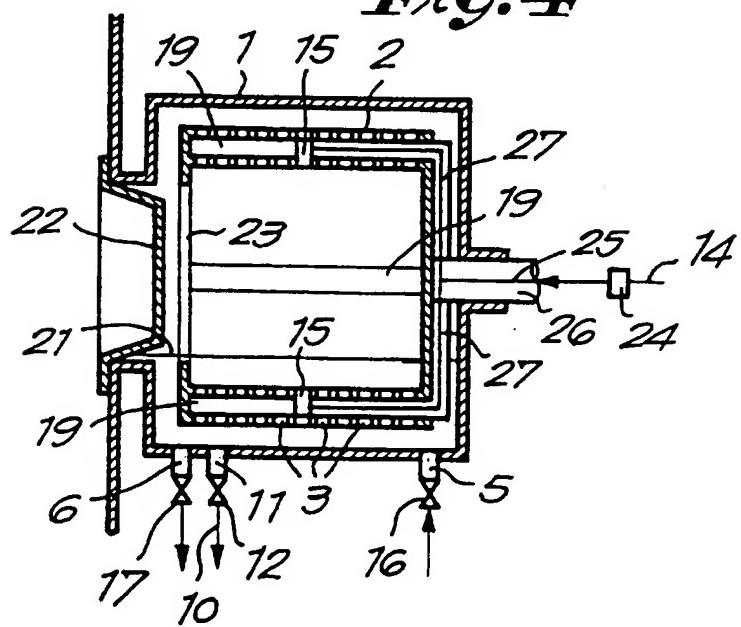
9. Washing machine according to any of claims 4 or 5,  
characterized in that the inner drum (2) is provided with  
ribs (19) and in that the nozzles (15) are situated in  
15 the ribs (19).

10. Washing machine according to any of claims 8 or 9,  
characterized in that the means (7) to inject water under  
pressure contain a duct (25) in the shaft (26) with which  
20 the inner drum (2) is mounted in a rotating manner in the  
outer drum (1), a rotating coupling (24), a water conduit  
(14) which is connected onto the rotating coupling (24)  
and a conduit (27) which is connected onto one end of the  
duct (25).

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*Fig. 1**Fig. 2*

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*Fig. 3**Fig. 4*

## INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 D06F35/00 D06F39/08

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 D06F

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE,A,42 36 873 (H. FALLER) 5 May 1994 see claims; figures ---	1-5,7
X	EP,A,0 146 719 (INDUSTRIE ZANUSSI S.P.A.) 3 July 1985 see page 6, line 29 - page 7, line 24; figures 1,2 ---	1-6,9,10
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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EP-A-146719	03-07-85	DE-A- 3468453 US-A- 4580421		11-02-88 08-04-86
FR-A-2525645	28-10-83	NONE		